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# PATENT SPECIFICATION



Application Date: Jan. 2, 1925. No. 117 / 25. **245,928**

Complete Left: Sept. 3, 1925.

Complete Accepted: Jan. 21, 1926.

## PROVISIONAL SPECIFICATION.

### Improvements in or relating to Circular Knitting Machines.

I, WILLIAM HENRY CLAUDE SPENCER, a British subject, of 11, Abney Street, East Park Road, Leicester, do hereby declare the nature of this invention to be as follows:—

This invention relates to circular knitting machines and has for its object a circular latch needle machine of improved form capable of producing plain fabric at a high rate of speed, requiring but little power to drive it and having the further advantage of permitting ready inspection of the knitted web as it comes from the needles.

The invention is mainly intended for application to fine gauge machines but is not limited in this respect. Further, it is intended for application to multiple feeder machines but may be adopted in machines having a single feeder.

The chief aim of the invention is to produce a circular latch needle knitting machine capable of producing fine regular fabric like that made on a "Terrot" or similar bearded needle machine, but at an increased speed.

The invention consists of a circular knitting machine having a series of latch needles radially disposed and a series of sinkers or like instruments situated intermediate of said needles and co-operating therewith for loop-forming knocking-over and web holding purposes.

Preferably, the improved machine has a series of dial needles working horizontally and a series of sinkers working vertically between the needles. In this arrangement the sinkers are carried in a cylinder or other suitable bed underneath the dial and have vertical movement in tricks in said cylinder or bed so as to co-operate with the needles which have the usual radial movements in the dial.

In the improved machine the tubular  
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plain fabric is knitted on the dial needles and passes therefrom inside out.

The sinkers are carried in a cylinder or bed situated on the inside of the tubular fabric consequently as the latter comes from the needles it can be readily inspected as it is entirely exposed on the outside of the machine.

In the preferred embodiment of the invention the machine has a suitable dial tricked radially in its upper face to carry latch needles which slide and are actuated by cams on a dial cam cap. Under the dial is a cylinder or circular bed the periphery of which is grooved or tricked vertically (like a needle cylinder) to carry slidable sinkers which are disposed between the needles and have up and down movements imparted to them by cams in or on a surrounding cam shell said cams acting on butts or shoulders on the sinkers. The sinkers are formed with a hook or throat at the top which throat is adapted to engage the web when the sinkers descend and to hold same while the needles move outwards to clear. A vertical front edge on the sinker extending downwards from the throat serves as an edge over which the sinker loops are drawn by inward movement of the needles and also as a knocking over edge. The vertical sliding movement of the sinker is for the purpose of bringing the throat or hook into and out of engagement with the web.

The lower portion or stem of the sinker is offset that is to say it is set back from the upper operative portion and the cams act upon the offset portion. By using sinkers of this form it will be understood that the diameter of the lower part of the series of sinkers is less than that of the upper part, consequently the sinker cam shell can be made of the same or a less diameter than that of the dial

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or at any rate can be made of such diameter as to allow the tubular fabric to pass over the outside of it without undesirable stretch as said tube comes down from the needles.

In a convenient constructional form the sinker is set back at right angles at a point approximately midway of its length. Or, in other words its upper and lower parallel portions are connected by a central limb at right angles thereto.

While the invention may be carried out in a machine having a stationary dial and sinker bed it is preferred to make the dial and sinker cylinder or bed rotary and the dial and sinker cams stationary. It is a decided advantage to make the dial and sinker cylinder rotary as these beds can be carried by a single central shaft or member which requires a bearing of small diameter, consequently the machine may be run at high speed and requires but little power to drive it. The sinker cylinder or bed may be attached to the underside of the dial or it may be formed on it but in any case these two beds revolve together as one block. The sinker cam shell, which it will be understood surrounds the sinker cylinder and over which the tubular fabric passes, may be supported underneath by suitable

means from the centre of the machine such for example as from a central shaft or post about which the dial and sinker cylinder revolve as or on a sleeve. It should be stated that the novel feature of my machine is that knitting takes place on a series of dial or like needles without the co-operation of cylinder needles and as far as I am aware this is the first latch needle machine of this form. I believe it is also the first machine wherein a series of sinkers is used in conjunction with a series of dial or like latch needles for making tubular fabric in continuous length knitted inside out.

The invention is therefore to be regarded in a broad sense as covering any machine embodying these novel features without limitation as to details of construction which may be varied without departing from the scope of the invention.

Dated this 1st day of January, 1925.

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Applicant,

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Chartered Patent Agents,  
Berridge Street Chambers, Leicester,  
Agents for the Applicant.

## COMPLETE SPECIFICATION.

### Improvements in or relating to Circular Knitting Machines.

I, WILLIAM HENRY CLAUDE SPENCER, a British subject, of 11, Abney Street, East Park Road, Leicester, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to circular knitting machines and has for its object a circular latch needle machine of improved form capable of producing plain fabric at a high rate of speed, requiring but little power to drive it and having the further advantage of permitting ready inspection of the knitted web as it comes from the needles.

The invention is mainly intended for application to fine gauge machines but is not limited in this respect. Further, it is intended for application to multiple feeder machines but may be adopted in machines having a single feeder.

The chief aim of the invention is to produce a circular latch needle knitting machine capable of producing fine regular fabric like that made on a

“Terrot” or similar bearded needle machine, but at an increased speed.

The invention consists of a circular knitting machine having a series of latch needles radially disposed and operating at the periphery of a circular needle bed, and a series of sinkers or like instruments situated intermediate of said needles and co-operating therewith for loop-forming knocking-over and web holding purposes.

Preferably, the improved machine has a series of dial needles working horizontally and a series of sinkers working vertically between the needles. In this arrangement the sinkers are carried in a cylinder or other suitable bed underneath the dial and have vertical movement in tricks in said cylinder or bed so as to co-operate with the needles which have the usual radial movements in the dial.

In the improved machine the tubular plain fabric is knitted on the dial needles and passes therefrom inside out.

The sinkers are carried in a cylinder or bed situated on the inside of the

tubular fabric consequently as the latter comes from the needles it can be readily inspected as it is entirely exposed on the outside of the machine.

- 5 To enable the invention to be more clearly understood I will now describe by way of example and with reference to the accompanying drawings, a specific form of the invention as applied to a multiple  
10 feeder machine.

In the drawings:—

Figure 1 is a front elevation of the head of the machine.

- 15 Figure 2 is a sectional elevation of the same.

Figure 3 is an elevation of a sinker per se.

Figure 4 is an inside plan view of one set of knitting cams.

- 20 Figure 5 is a sectional elevation, taken on line V—V of Figure 4, and shows means for adjusting the stitch cam.

Figure 6 is an inside view of a section of the sinker cams.

- 25 Figure 7 is a sectional elevation, taken on line VII—VII of Figure 6, of a detail hereinafter particularly referred to.

- 30 Figures 8 to 11 are sectional details illustrating the action of the needles and sinkers, and

Figure 12 is an underside plan of means for adjusting the sinker cams relatively to the sinkers.

- 35 Figures 1 and 2 are drawn to a smaller scale than the remaining figures of the drawings.

- Referring to the drawings, the machine embodies a head piece 1 rigidly supported by a framework comprising rods or bars 2 and 3 and eyepieces 4, said framework being carried by a bed plate or ring 5 rigidly attached in its turn to a suitable frame or stand (not shown).  
40 The said head piece 1 is formed or fitted with a depending tubular boss or sleeve 6. Rotatable about this boss or sleeve is a dial 7 tricked radially in its upper face for the reception of latch needles 8 which slide and are actuated, as will be described later herein, by cams in a dial  
45 cam cap 9 rigidly attached by screws or in any other suitable manner to a flange 1a on the head piece 1. This cam cap may serve to support feeders or feed  
50 plates 10 which may be adjustably attached by screws to angle brackets 11 secured to the cam cap by means of screws. Said feeders, of which there are eight in the present instance, are, of course, disposed equidistantly around the cam cap. Feeders of any other suitable form may be employed if desired.

- 65 Preferably the cam cap is of a sectional character i.e. it is divided into an equal

number of sections. For example there may be as many sections as feeders and each section may carry the necessary cams for enabling the needles to take and knit the yarn at the corresponding feeder. Thus in the machine illustrated there are eight sections one of which is shown inverted in Figure 4 with the knitting cams in position thereon. These  
70 cams comprise a clearing cam 12 and a stitch cam 13 with which cam members 14 and 15 are associated to form a track 16 for the butts of the needles. It will be understood that when the various sections are in position a continuous track  
75 is formed for the needle butts. Preferably the clearing cam and the stitch cam are made adjustable on the cam cap. To this end the cam 12 may conveniently be fulcrummed at 17 and fitted with a screw 18 inserted through a clearance hole or slot 19 in the cap so that when the screw is slack the cam may be adjusted as required after which it may be fixed in position by tightening the screw down on the outside of the cap. Similarly the  
80 stitch cam 13 may be fulcrummed at 20 and fitted with a screw 21 (see particularly Figure 5) inserted through a clearance hole or slot 22 in the cap, said screw being engaged on one side by a screw 23 inserted in a tapped hole in the side of the cap and on the other side by a compression spring 24 located in hole in the cap in alignment with the screw  
85 23. By rotating this screw in one direction or the other when the screw 21 is slack the necessary adjustment of the stitch cam may be effected. The cam 13 may be locked in position after adjustment by tightening the screw 21 down upon the outside of the cap.

Under the dial 7 is a cylinder or circular bed 25 the periphery of which is grooved or tricked vertically (like a needle cylinder) to carry slidable sinkers 26 which are disposed between the needles 8 and have up and down movements imparted to them by cams in or on a surrounding cam shell 27 as will be hereinafter described. While the invention may be carried out in a machine having a stationary dial and sinker bed it is preferred to make these parts rotary and the dial and sinker cams stationary.  
90 120 It is a decided advantage to make the dial and sinker cylinder rotary as a bearing of but a small diameter is required, consequently the machine may be run at high speed and requires but little power to drive it. The cylinder 25 may be attached to the underside of the dial, for example by screws, or it may be formed on it, but in any case these two beds revolve together as one block.  
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The sinker cam shell 27 may be supported underneath by suitable means from the centre of the machine. Conveniently said shell fits over and is supported by a plate or flange 28 for which purpose the latter may be formed with a rim or bead 28a which fits into a recess 27a in the said shell. This plate or flange is in turn rigidly attached to the boss or sleeve 6 by screws 46 and also serves to support the dial 7 and cylinder 25 through the medium of a ball thrust washer 30. Provision may be made for adjusting the plate or flange 28 vertically to take up slackness due to wear. Conveniently for this purpose a key 31 held in position by screws 32 is provided between the plate or flange and the sleeve 6, and is slidable in a keyway 33 formed in the latter. Adjustment is effected by slackening the screws 29 and 32 and moving the plate or flange to the extent required after which it may be locked in position by tightening the screws again.

Each of the sinkers 26 is formed with a hook or throat 26a see Figures 2 and 3, at the top and has a vertical front edge 26b extending downwards from said throat. The lower portion of the sinker is offset, that is to say it is set back from the upper operative portion, and the sinker cams act upon the offset portion. By using sinkers of this form it will be understood that the diameter of the lower part of the series of sinkers is less than that of the upper part, consequently the sinker cam shell can be made of approximately the same diameter as or even a less diameter than that of the dial, or at any rate can be made of such diameter as to allow the tubular fabric to pass over the outside of it, as represented at 34 in Figure 2, without undesirable stretch as said tube comes down from the needles. In a convenient constructional form the sinker is set back at right angles at a point approximately midway of its length. Or, in other words, its upper and lower parallel portions are connected by a central limb at right angles thereto and which forms a shoulder 26c for a purpose hereinafter stated. The lower portion of the sinker is also formed with a butt 26d. The periphery of the dial 7 is preferably tricked to receive and steady the upper portions of the sinkers so as to counteract any tendency on the part of the latter to spring.

Fitted on the interior of the cam shell 27 adjacent to each feeder of the machine is a sinker cam 35 having upper and lower operative edges 35a and 35b respectively. Guide or guard cams 36 are provided between the sinker cams.

The cams 35 and 36 project into the recess formed by the shoulders 26c and the butts 26d of the sinkers that is to say the shoulders make contact with the upper edges of the cams and the butts make contact with the lower edges. Thus during the operation of the machine a vertical sliding movement is imparted to the sinkers by the cams 35 which movement is for bringing the throat or hook 26a into and out of contact with the web 34.

The sinker cams are preferably made adjustable vertically and to this end each cam may be pivotally mounted at 37 on the cam shell and tapped to receive a screw 38 inserted from the outside of the cam shell 27 through a slot 39 the screw being tightened down upon the shell after the required adjustment of the cam has been effected.

Referring to Figures 4 and 6 the arrangement of the needle actuating cams and the sinker cam at each feeder is such that prior to the knitting action the needles and sinkers occupy a relative position somewhat as represented in Figure 8, it being assumed for purposes of exemplification that a needle is in the position indicated by A in Figure 4 in the cam track 16 and that the adjacent sinker is in the position indicated by a in Figure 6 on the cam member 36. In this position the throat or hook of the sinker engages the web 34 to hold same down. As the needle and sinker approach a feeder in the direction represented by the arrows in the figures aforesaid, during the rotation of the dial 7 and cylinder 25 the needle is first engaged by the clearing cam 12 and is thereby moved outwards to clear while the sinker remains at the same level. At this stage the needle and sinker are at the points B and b in their respective cam systems and the corresponding relative position is somewhat as represented in Figure 9. The cam member 14 then acts to move the needle inwards so that it takes the yarn, while the sinker is raised out of engagement with the web by the action of the edge 35a of the sinker cam. Figure 10 shows the relation between the sinker and the needles when the latter is about to take the yarn these positions corresponding with the points C and c respectively in Figures 4 and 6. It may be mentioned here that the vertical front edge 26b of the sinker serves as an edge over which the sinker loops are drawn and also as a knocking over edge during further inward movement of the needle to complete the stitch formation. This further inward movement, during which the needle draws the new loop and

knocks over the old loop, is imparted by the stitch cam 13 and in the meantime the sinker is caused to descend to its normal level again to engage the web by the action of the edge 35b of the sinker cam 35 on the butt 26d. Figure 11 represents the relative position of the needle and sinker at this stage in the operation i.e. when they are at the points D and d in their respective cam systems. Finally the needle is projected again to its normal position by the cam member 15 in readiness for a repetition of the action at the next adjacent feeder.

The sinker cam shell 27 is preferably rotatably mounted on its support 28 so that the sinker cams may be adjusted relatively to the sinkers, if necessary, suitable means being provided for effecting said adjustment. Conveniently said means comprise two levers 40 fulcrummed upon screws 41 disposed at diametrically opposite points in the support 28. Associated with each lever so as to impinge upon opposite sides thereof are two adjusting screws 42 see especially Figure 12 threaded through lugs 43 and fitted with lock nuts 44. Each lever is formed with a bifurcated end adapted to engage the head of a corresponding screw 45 fixed in the cam shell, so that by slackening the lock nuts and appropriately rotating the screws 42 the shell may be rotated relatively to its support in one direction or the other according to the adjustment required. The aforesaid adjusting means also serve to hold the shell in position after adjustment. The screws 45 together with additional screws 29 spaced at suitable intervals apart round the lower edge of the cam shell engage the support 28 and thus prevent downward movement of the latter relatively to the cam shell when the screws 46 and 32 are slackened.

In order to facilitate insertion and removal of the sinkers, a gap or opening 47 see Figures 1, 6 and 7, may be formed in the cam shell 27 and the sinker cam system and normally closed by a removable gate 48.

The rotary dial 7 and sinker cylinder 25 may be driven in any suitable manner. In the arrangement illustrated the machine is fitted with a main shaft 49 adapted to be driven, preferably through the medium of a clutch (not shown) of any suitable type, by belt and pulley gear (not shown) from any suitable source of power. Conveniently this shaft is carried by bearings 50 mounted on the horizontal bars 2, and has a bevel pinion 51 fast thereon. This pinion meshes with a bevel gear 52 fast on a vertical shaft 53 rotatable at one end in a sleeve or bush 54 removably fixed in the

head piece 1. At the other end the said shaft rotates in a suitable bearing on a housing 55. Fast on the shaft 53 is a spur pinion 56 which meshes with a spur gear 57 formed integrally with the dial, whereby motion is transmitted to the latter and consequently to the sinker cylinder. The provision of the removable bush 54 enables the shaft 53 with the aforesaid gears thereon to be readily fitted in and removed from the head 1.

The machine is fitted with a take down gear of any suitable type (not shown) and said gear may be driven through suitable intermediate mechanism from a shaft 58 rotatable in the head piece 1 and fitted with a spur gear 59 which meshes with a pinion 60 on the shaft 53 and rotates within the housing 55. The said housing also constitutes a support for a spindle or port 61 which carries a superstructure (not shown) comprising suitable bobbin carriers and yarn guides.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A circular knitting machine having a series of latch needles radially disposed and operating at the periphery of a circular needle bed, and a series of sinkers or like instruments, situated intermediate of said needles and co-operating therewith for loop-forming, knocking-over, and web-holding purposes, for the purpose specified.

2. A circular knitting machine according to Claim 1, which includes a sinker system of such form and arrangement that as the knitted fabric comes from the needles it passes over the outside of said system and is thus entirely exposed on the outside of the machine so that it can be readily inspected.

3. A circular knitting machine as claimed in Claim 1 or 2, having a dial tricked radially in its upper face to carry latch needles which slide and are actuated by cams on a dial cap, and a vertically tricked cylinder or circular bed supported under the dial and furnished with slidable sinkers which are disposed between the needles and have up and down movements imparted to them by cams in or on a surrounding cam shell.

4. A circular knitting machine according to Claim 3, wherein the dial cams include adjustable clearing and stitch cams, substantially as described.

5. A circular knitting machine as claimed in Claim 3, wherein the dial is rotatable about a tubular boss or sleeve on a fixed head to which the dial cam

cap, preferably formed in sections is attached, and has the sinker cylinder or bed attached to it so that these two parts revolve together as one block, and the sinker cam shell is supported underneath by a plate or flange also attached to the tubular boss or sleeve on the fixed head.

6. A circular knitting machine according to Claim 5, wherein the support for the sinker cam shell also serves to support the dial and the sinker cylinder through the medium of a ball thrust washer, and is adjustable vertically for taking up slackness due to wear.

7. A circular knitting machine according to Claim 5 or 6, wherein the sinker cam shell is rotatably mounted on its support so that the sinker cams may be adjusted relatively to the sinkers, and means are provided for effecting such adjustment, and holding the shell in position after adjustment.

8. For a circular knitting machine according to any one of the preceding Claims, a sinker formed with a hook or throat at the top, a vertical front edge, and a lower portion which is offset i.e. set back from the upper operative portion, for the purpose described.

9. For a circular knitting machine according to any one of Claims 1 to 7, a sinker as claimed in Claim 8, having parallel upper and lower portions connected by a central limb at right angles thereto thereby forming a shoulder, and

a butt on the lower portion, substantially as and for the purpose herein described.

10. In a circular knitting machine as claimed in any one of Claims 1 to 7, and equipped with sinkers as claimed in Claim 8 or 9, the provision at the feeder or each feeder of the machine of a sinker having upper and lower operative edges and preferably adjustable and a guard cam or guard cams cooperating with said sinker cam or cams, substantially as and for the purpose herein described.

11. In a circular knitting machine as claimed in Claim 5, driving gear comprising a main shaft, preferably clutch driven gears for transmitting the drive from said shaft to a secondary shaft, and gears whereby the motion is transmitted from said secondary shaft to the dial and consequently to the sinker cylinder, substantially as described.

12. A circular knitting machine constructed, arranged, and adapted to operate substantially in the manner as and for the purpose herein described with reference to the accompanying drawings.

Dated this 28th day of August, 1925.

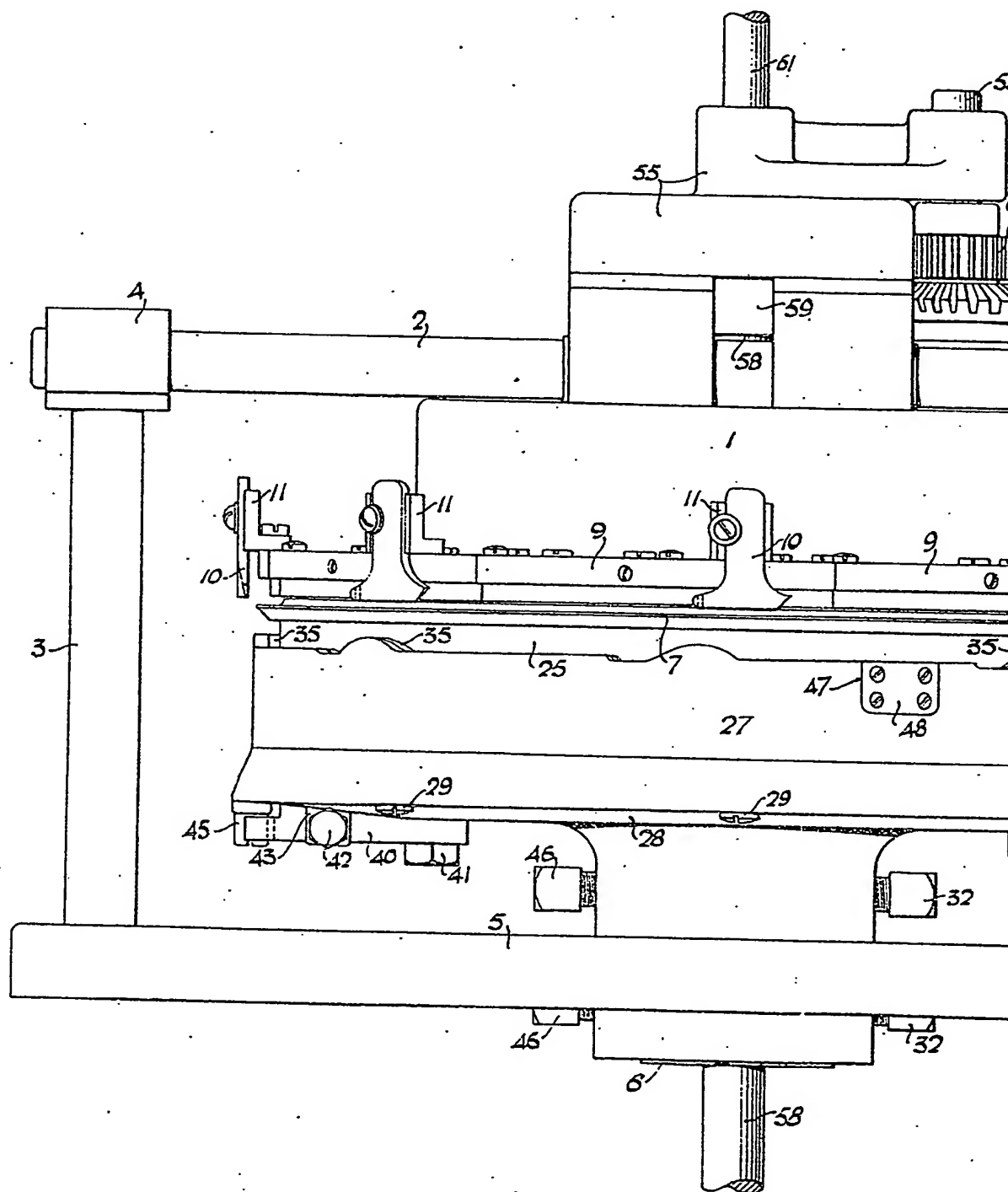
WILLIAM HENRY CLAUDE  
SPENCER,

Applicant,

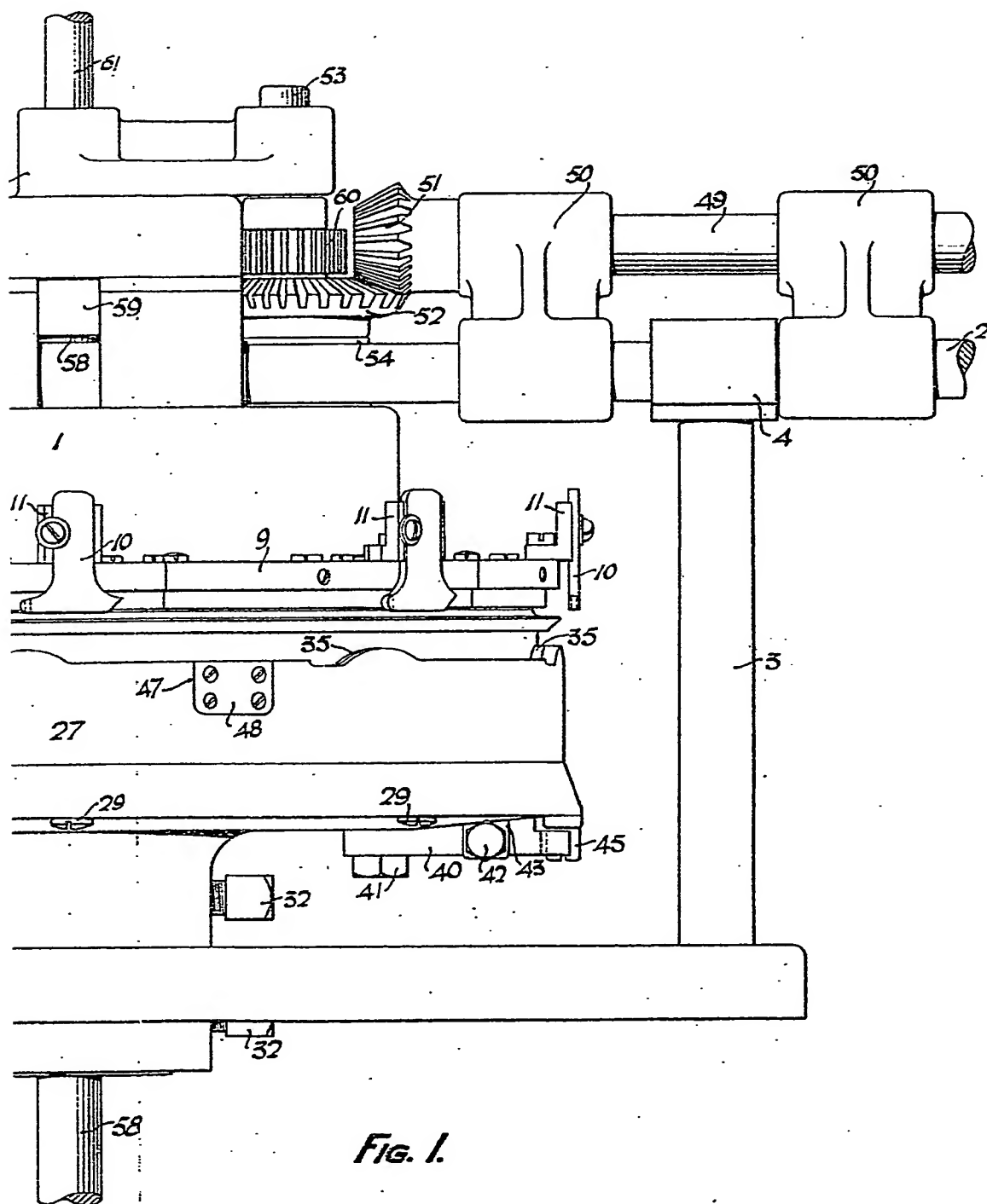
E. N. Lewis & Taylor,  
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Berridge Street Chambers, Leicester,  
Agents for the Applicant.

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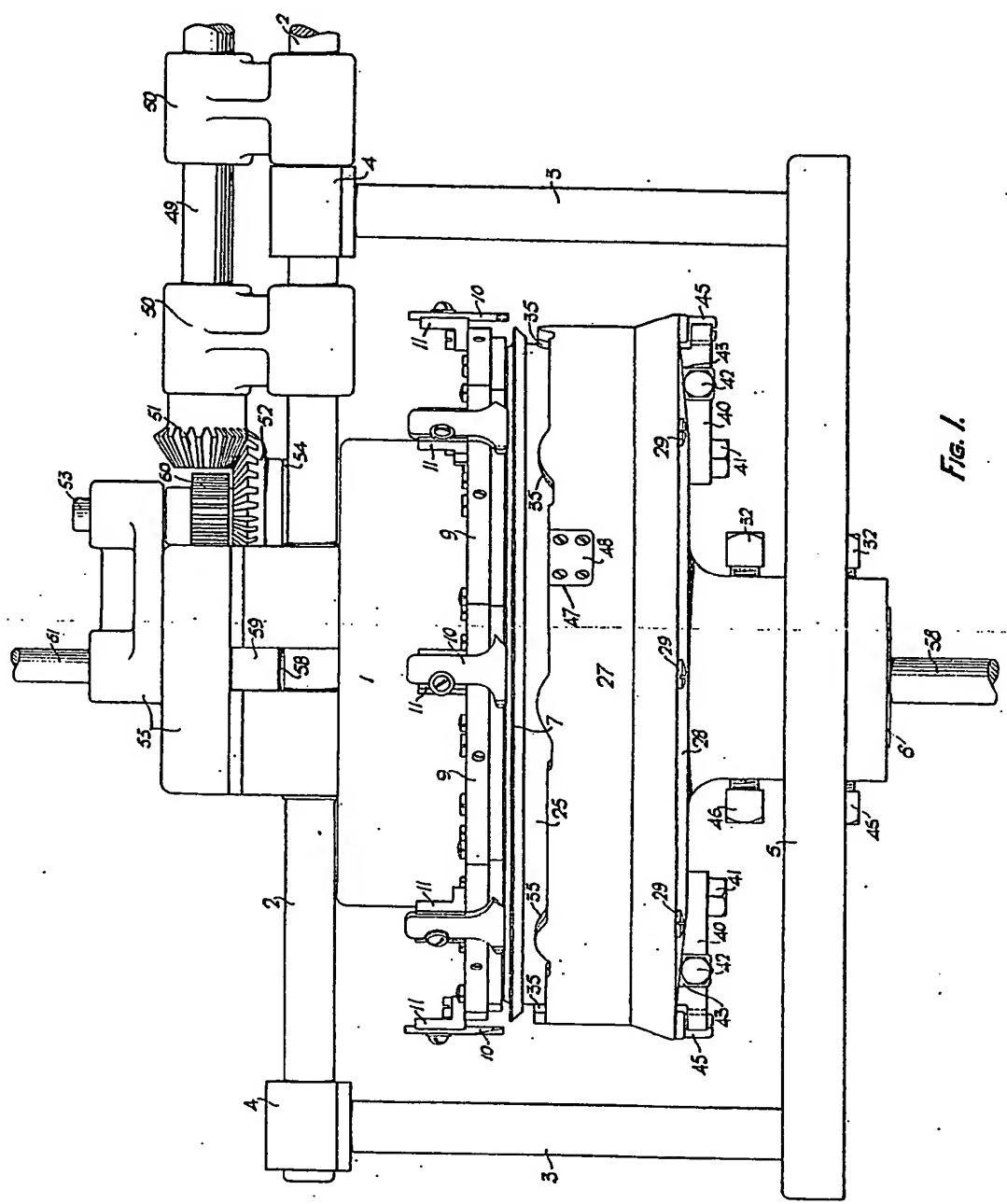
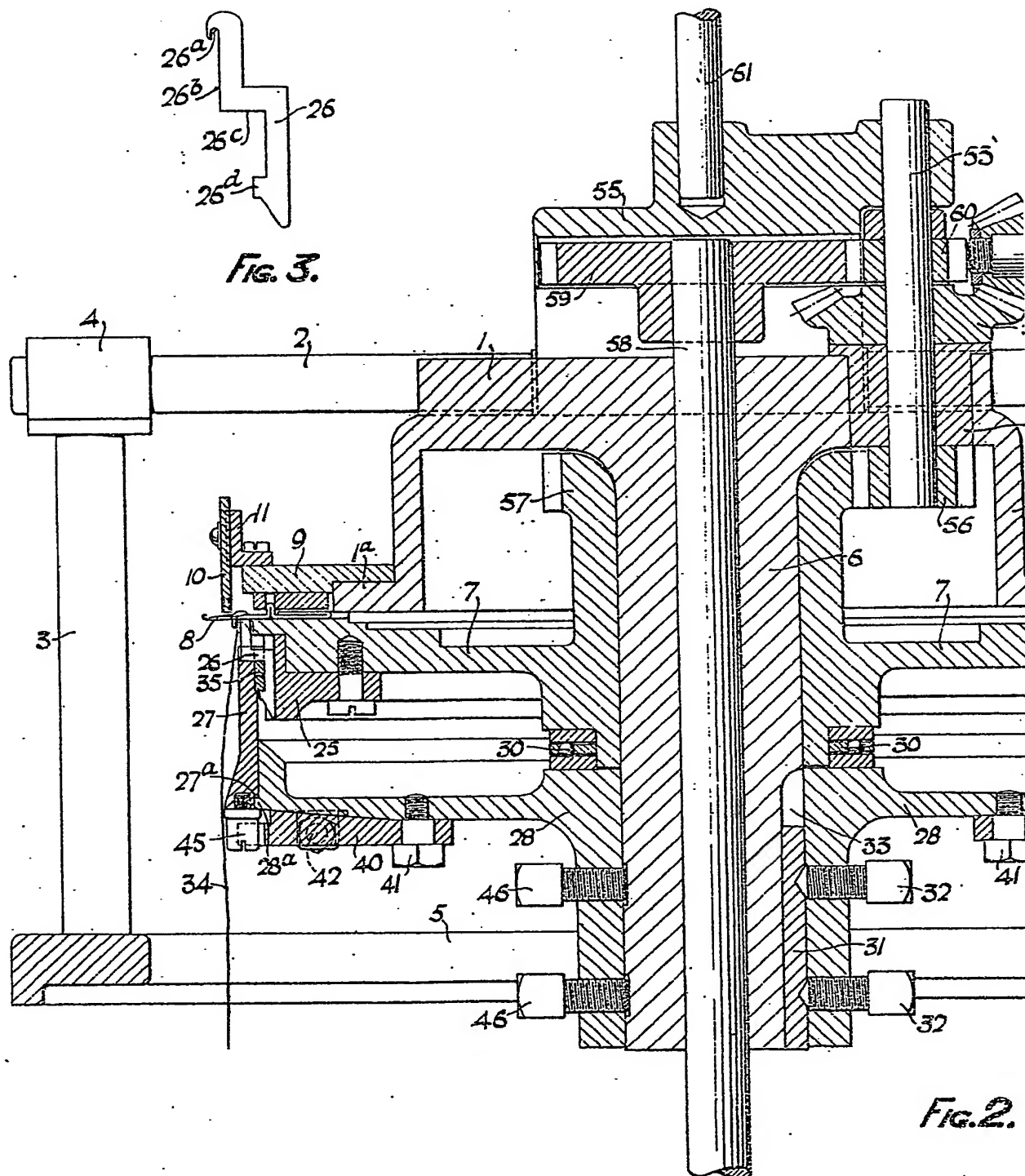
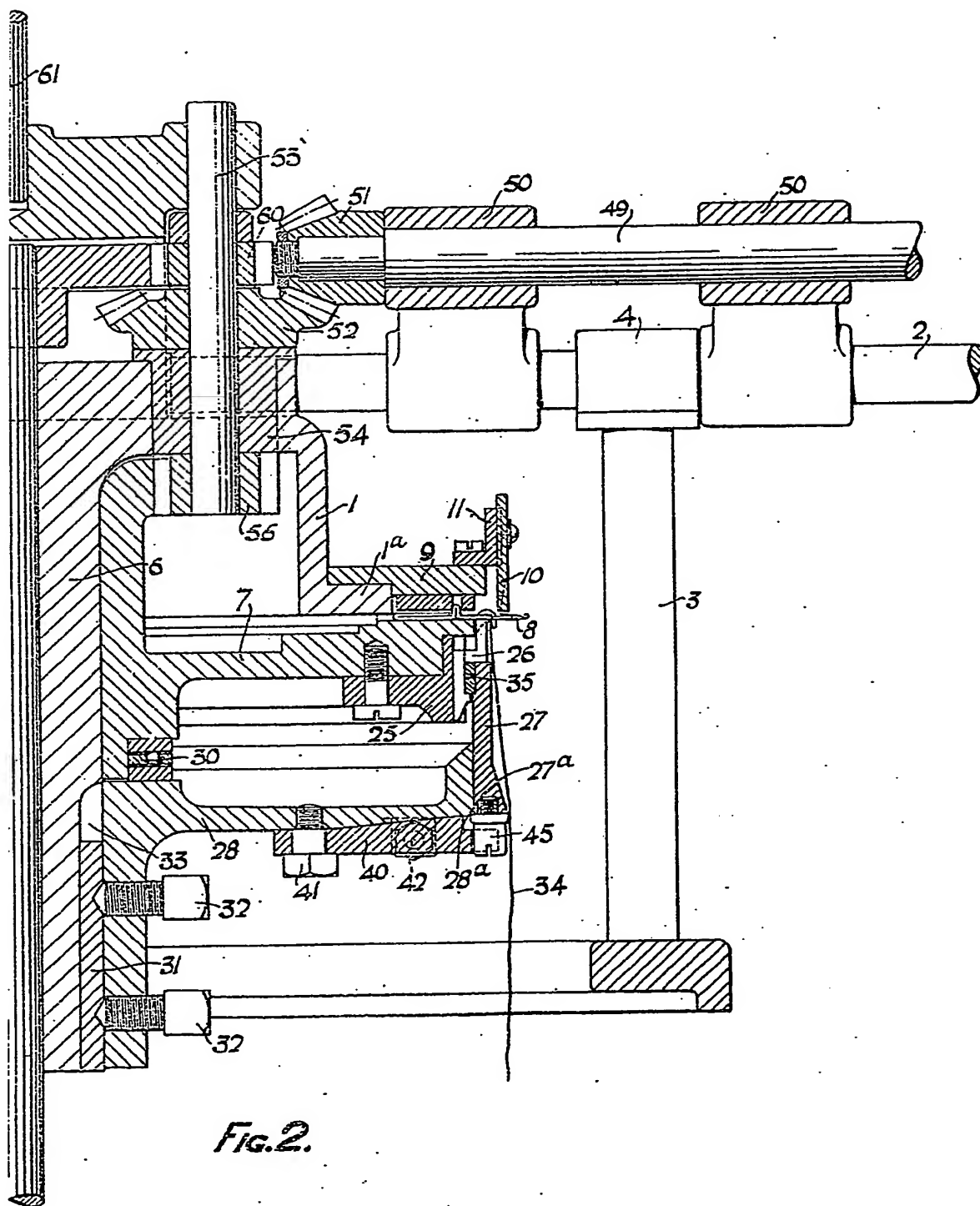


Fig. 1.

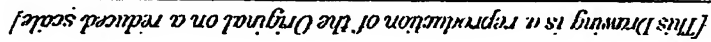
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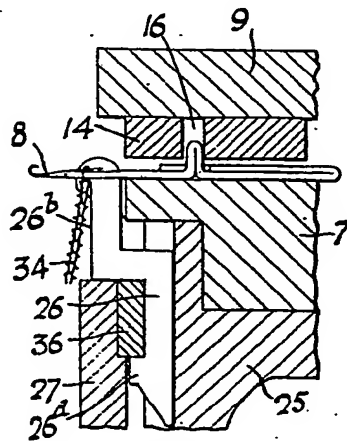
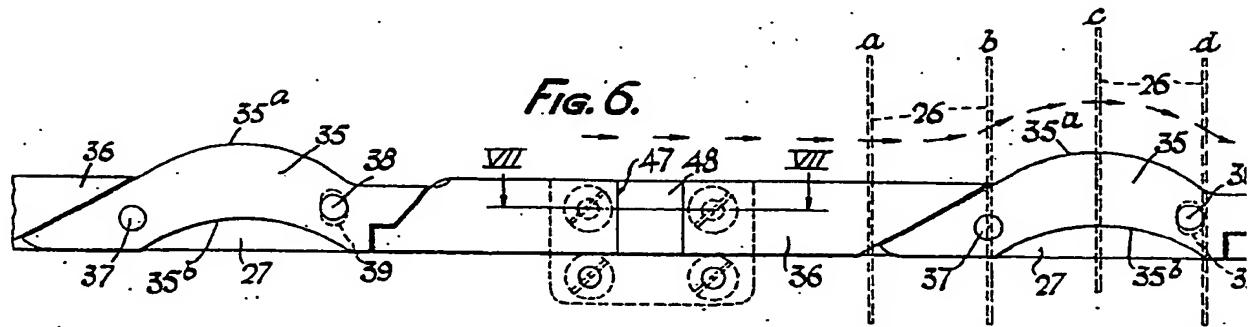


Fig. 8.

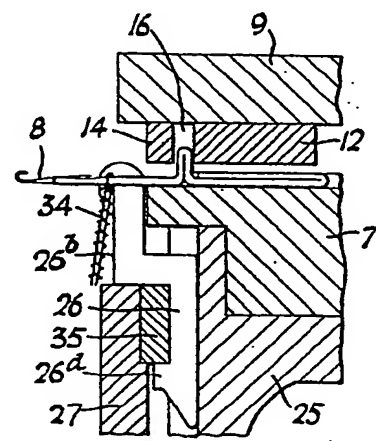


Fig. 9.

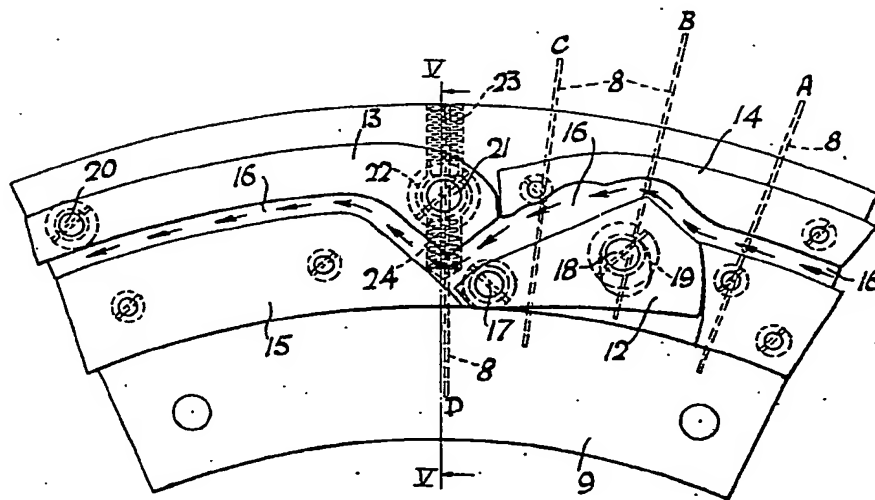
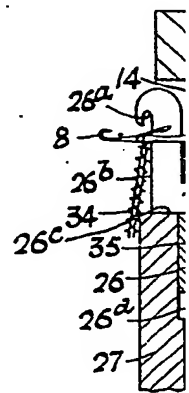


Fig. 4.

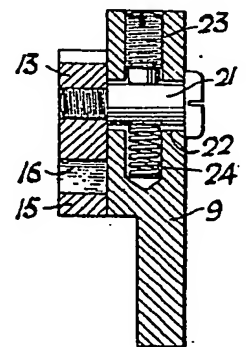


Fig. 5.

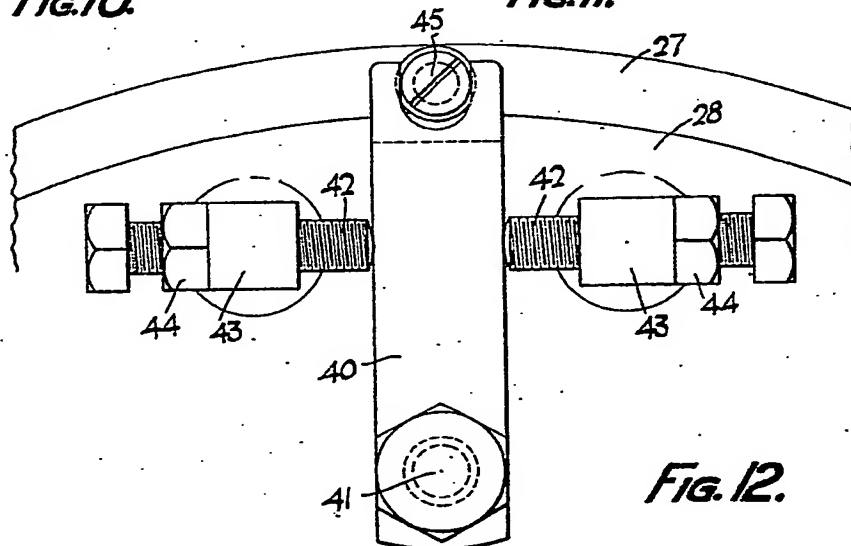
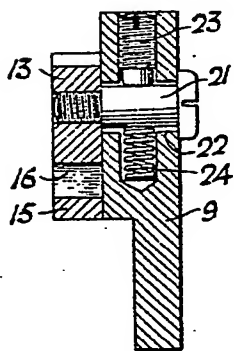
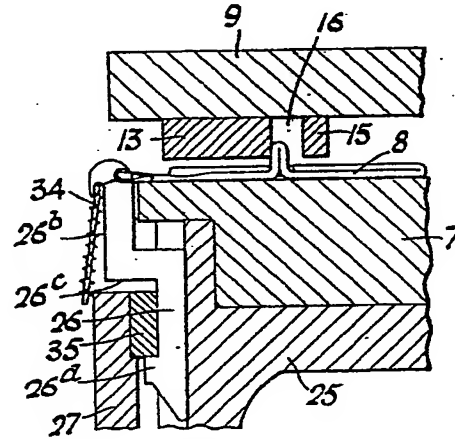
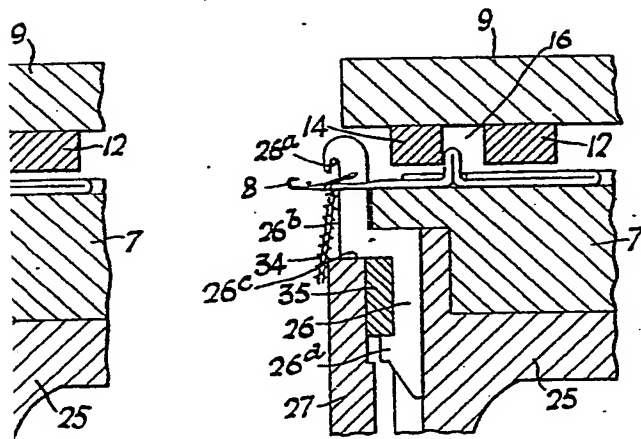
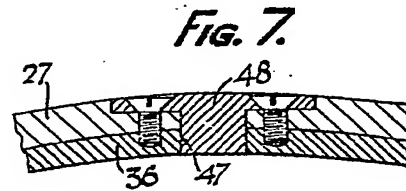
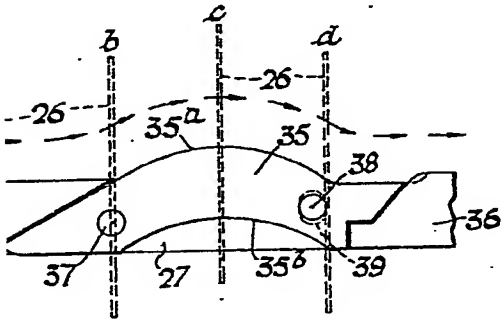


Fig. 5.

Fig. 12.

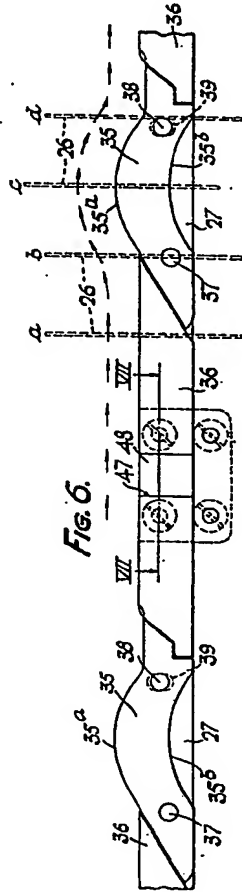


Fig. 6.



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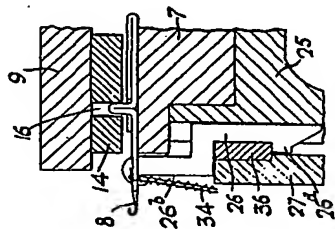


Fig. 8.

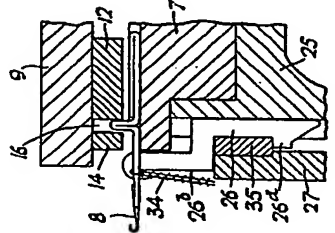


Fig. 9.

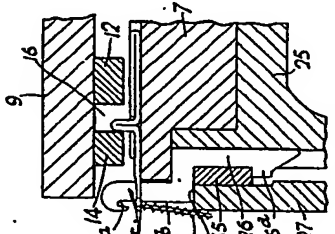


Fig. 10.

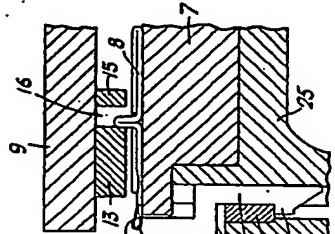


Fig. 11.

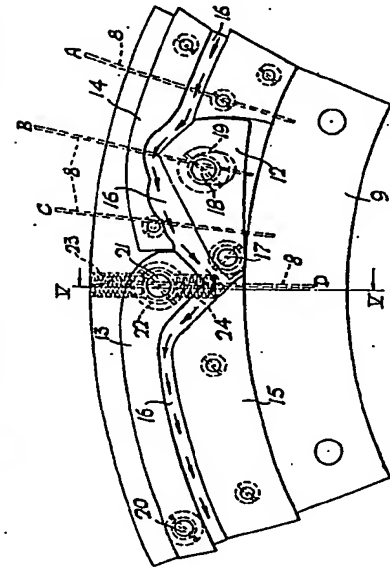


Fig. 4.

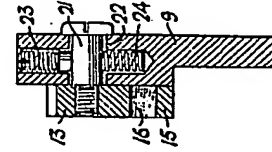


Fig. 5.

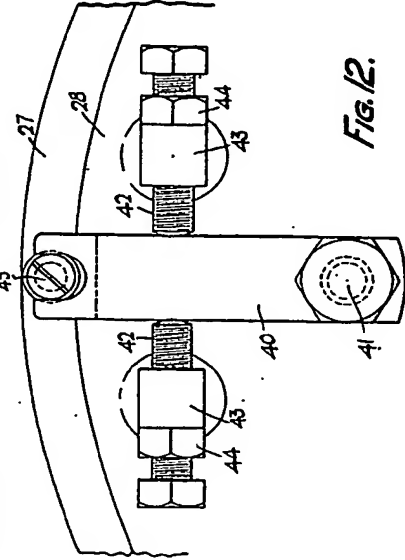


Fig. 12.

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